A STUDY OF THE TAR SPRINGS SANDSTONE IN SOUTHEASTERN ILLINOIS

BY

BENJAMIN GROTE

B.Ed., Western Illinois State Teachers College, 1928
A.M., University of Illinois, 1934

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN GEOLOGY
IN THE GRADUATE COLLEGE OF THE
UNIVERSITY OF ILLINOIS, 1949

URBANA, ILLINOIS

1949

A STUDY OF THE TAR SPRINGS SANDSTONE IN SOUTHEASTERN ILLINOIS

BY

BENJAMIN GROTE

B.Ed., Western Illinois State Teachers College, 1928
A.M., University of Illinois, 1934

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN GEOLOGY
IN THE GRADUATE COLLEGE OF THE
UNIVERSITY OF ILLINOIS, 1949

URBANA, ILLINOIS

1949

ACKNOWLEDGMENTS

Partly because of the extended period of time covered and partly because of the dual facilities utilized, a large number of people assisted in the preparation of this thesis. The advice received from Harold R. Wanless, University of Illinois, in connection with selection of the problem and initial stages of the study is gratefully acknowledged. Because Professor Wanless was absent from the university during the final stages of the study, Jack L. Hough served as advisor at that time. Recognition of the able assistance given by Professor Hough is hereby expressed. Facilities of the Department of Geology, University of Illinois, were provided under the direction of F. W. DeWolf and George W. White, each of whom served as Chairman of the department at some stage of the study. Other members of the staff, Department of Geology, University of Illinois, assisted in the fields of their specialization.

A major part of the research was accomplished in the offices and laboratories of the Illinois State Geological Survey, Urbana, Illinois. Facilities in that institution were made available by its chief, M. M. Leighton. Especial recognition is given to L. E. Workman, David H. Swann, and Elwood Atherton, Illinois State Geological Survey, for their counsel and generous use of time. Many members of the staff, Illinois State Geological Survey, assisted in the areas of their specialization, especially in matters of drafting and reproducing maps and figures. Also, my wife, Esther Grote, did some of the drafting and tedious clerical work.

R. UNIV. BIBLIOTHEEK LEIDEN

A STUDY OF THE TAR SPRINGS SANDSTONE IN SOUTHEASTERN ILLINOIS

This study was made to determine some of the lithologic characteristics of the Tar Springs sandstone in Hamilton, White, and most of Saline and Gallatin counties. Specific objectives of the study follow:

1. To determine and illustrate the general thickness variations within the formation.

2. To determine and illustrate major lithologic characteristics.

3. To make an analysis of available porosity and permeability data.

4. To show information relative to the grain size of selected samples as revealed by sieve analyses.

5. To analyse the heavy mineral content of selected samples.

6. To analyse the characteristics of individual sandstone grains.

7. To present some interpretations of the sedimentary history of the formation.

8. To show the general structure of the Tar Springs formation.

This study has been conducted largely through a laboratory investigation of the sub-surface characteristics of the Tar Springs formation in the area indicated above. Thickness and structure data were secured from electric logs, supplemented by sample study. Data pertaining to the general lithology of the formation were secured from electric logs, core samples, well cuttings and porosity and permeability records. Sieve analyses were made from seventeen samples of the Tar Springs sandstone which were taken from eleven wells located within the area of study. The heavy minerals

were separated from grade size 0.125 to 0.074 millimeters and a heavy mineral count was made. Porosity and permeability data were compiled and analyzed to determine porosity and permeability characteristics of the formation. Selected samples of well cuttings and core chips were studied to determine characteristics of sandstone grains.

Although most writers refer to the Tar Springs "sandstone" they might more appropriately use the expression Tar Springs "formation" because this lithologic unit consists of sandstone, shale, shaly sandstone, siltstone, coal, and even limestones have been reported to lie within the formation. This study revealed that in a particular area the thickness of the Tar Springs formation varies from 48 to 158 feet, the percentage of sandstone in the formation varies from 0 to nearly 100 percent, and that these variations take place in short distances. Permeability and porosity characteristics vary greatly both laterally and vertically. For the most part the sandstones of the formation consist of very fine grains although some consist of fine grains and still others have significant qualities of medium grains. Heavy minerals, which make up only about one sixth of one percent of typical samples, are composed mostly of leucoxene, pyrite, other opaque minerals, zircon, and tourmaline. The faces of typical sandstone grains are fracture surfaces which are free from marks of abrasion but some grains show crystal faces which indicate secondary crystallization. Grains are cemented together with calcite, silica, and clay. Sandstone grains are normally subangular and have a low sphericity. Fossils observed in the study are limited to carbonaceous remains which suggest plant origin; terrestrial plants have been reported from other areas.

Production of oil from the Tar Springs has been largely from areas where the formation is relatively thick and structurally high. Because of the irregularity of composition of the formation, it is important that oil prospecting be based upon lithologic characteristics as well as upon structure. Production from stratigraphic traps or some combination of stratigraphic and structural traps should be expected.

VITA

Benjamin Grote, son of George Benjamin and Minnie Bubb Grote, was born at Griggsville, Illinois, on August 13, 1906. After having completed the elementary school curriculum presented by Shelley rural school, Pike County, Illinois, and the secondary school curriculum offered by the Griggsville Community High School, Griggsville, Illinois, he attended Western Illinois State Teachers College, Macomb, Illinois, where he graduated with the degree of Bachelor of Education in 1928.

Prior to graduation from college he taught one year, 1925-1926, in a rural school of Pike County, Illinois. From 1928 to 1935 he taught mathematics and science in the Bluffs Community High School, Bluffs, Illinois. Within this period he attended summer sessions of the University of Illinois, receiving the degree of Master of Arts in Education in 1934.

In 1935 he was appointed superintendent of the Bluffs Public Schools, Bluffs, Illinois, which position was held until 1938 when he resigned to continue study at the University of Illinois in the field of geology.
In the period of 1938 to 1942 time was spent at the University of Illinois doing advanced study and part time teaching as an assistant in geology. All residence requirements, the preliminary examination, and language requirements for the doctorate were completed and research for the thesis started within this period. However, before the thesis was completed, the emergency of World War II required that study be suspended and that military service be performed.

Mr. Grote was commissioned as a second lieutenant in the United States Army on August 10, 1942, and served until April 27, 1948, at which time he was discharged as a major. From August 1942 until July 1945 he was assigned to the Training Command of the

Air Force and filled important positions in connection with Army Air Force Flexible Gunnery Training. In late 1945 he attended the School of Military Government at Charlottesville, Virginia, after which he was sent to Korea as a civil affairs officer. Upon being discharged from the army, he was retained in Korea to work as a Department of the Army Civilian, in which capacity he was the chief American advisor to the Korean Government in the field of adult education. This position was held until November 1948, at which time the American Department of Education of the United States Army in Korea was discontinued.

He was married to Viola Esther Nickel on July 6, 1929.

Membership in the following professional organizations was accepted within the years indicated: Kappa Delta Pi, Western Illinois State Teachers College, Macomb, Illinois, 1927; Kappa Phi Kappa, University of Illinois, 1933; Phi Delta Kappa, Uinversity of Illinois, 1934; Sigma Xi (associate member), University of Illinois, 1941. He is a member of the Presbyterian church.

Digitized by the Internet Archive
in 2026

https://archive.org/details/IA41549807_0074